



Organizing Economic Experiments: Property Rights and Firm Organization*

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Abstract. Many economists, notably Austrian economists, have argued that the market process is essentially an experimental process. We briefly try to clarify this conceptualization, and then argue that we may understand the firm in much the same light. A basic view of the firm as an experimental entity is derived, drawing on property rights insights.

Key Words: the theory of the firm, Austrian economics, property rights

JEL classification: D21, D23, D83.

Introduction

This paper aims at establishing links between market process economics (Boettke and Prychitko 1996) and the theory of economic organization, primarily the theory of the firm (Coase 1937, Williamson 1996, Hart 1995, Barzel 1997). To be sure, these links have been explored in previous contributions. For example, earlier work has assessed the contribution of Mises' (1936, 1949) analysis of economic calculation to the understanding of the efficient boundaries of the firm (Klein 1996), including issues of corporate governance (Klein and Klein 2001), or the contribution to knowledge about the internal organization of firms of Hayek's (1945) insights in dispersed knowledge (Jensen and Meckling 1992, Cowen and Parker 1997, Foss 1999), or how Austrian economics may inform the study of firm strategy (Jacobson 1992, Lewin and Phelan 2000). However, the perspective in the present paper is different from these contributions.

Specifically, we begin from the conceptualization of the market process as not only a superior method of integrating dispersed knowledge, but also of producing new knowledge (novelties). One of the reasons for this superiority lies in the experimental nature of the market process: Experiments in products, processes, organization, etc. are continuously being conducted and evaluated. Alienable property rights enable decision-makers to carry out such experiments, to a large extent without seeking anybody's approval. It is a related

*The present paper represents an attempt to describe an overall "vision" for a research program that we have pursued alone, together, and in the context of the Learning, Incentives and Knowledge Program (*LINK*; <http://www.cbs.dk/link>) (Foss and Foss 2000a, 2000b, 2001, Foss 1999, 2000, 2001a, 2001c). This research program may briefly be described as an attempt to extend the reach of the property rights paradigm, particularly in more dynamic directions.

overall experimental view that we wish to transfer to the firm; thus, we consider a experimental activity in the context of firm organization.

Firms play a central and even dominant role in the process of economic experimenting as inventing and innovating teams. They are the basic *loci* of experiments with products, processes and modes of organization, as rich literatures on technology studies, innovation management, and firm strategy suggest (e.g., Jacobson 1992, D'Aveni 1994, Miles et al. 1997, Helper, McDuffie, and Sabel 2000). However, this is hardly reflected in neither Austrian economics, nor in the mainstream economics of organization. While Austrian economists have not been particularly interested in the innovative process,¹ economists of organization have apparently taken Oliver Williamson's (1985:141) observation that "[u]nfortunately, the study of innovation is enormously complex" to imply a license to be complete complacent about the study of such issues as technical change, learning by doing, and changes in the division of labor as these relate to economic organization. The basic point we develop in this paper is that a conceptualization of firms as experimenting teams not only furthers our understanding of the dynamics of the market process by allowing for a better understanding of the *loci* of experimental activity; it also allows us to develop novel insights into economic organization.

Novel products, processes and organizational forms are launched by firms (or groups of cooperating firms), and are tested in the experimental procedure of the market process. For example, novelties may become embodied in new products and enter into the market process in the form of transactions with consumers or industrial users. However, prior to this injection into the market process, novelties have been produced inside the firm, or, perhaps, in cooperative ventures between two or more firms. These processes also involve transactions, that is, the transfer of property rights, between various agents. As a huge literature argues, the definition, exchange and enforcement of property rights is not costless, the relevant costs being transaction costs (Barzel 1997). Therefore, performing economic experiments is costly, not only in terms of direct outlays (R&D expenses, etc.), or in the form of possible parallel experimentation, but also in terms of transaction costs.

Focusing on these costs and on how they are influenced by, and in turn influence, economic experiments allows us to address issues of economic organization (see also Foss and Foss 2000a, Foss 2001a). In order to focus this perspective, we examine the mechanisms inside firms that endogenously produce change, such as learning, experimenting, and increasing division of labor, and tie this to issue of coordination by managerial allocation of rights inside the firm. We argue that the firm may be understood as an institution that emerge in order to coordinate a complex division of labor in a technological system, characterized by ongoing, endogenous change. Our discussion contributes to at least two areas of research. First, we contribute to Austrian economics by arguing that the characteristically Austrian emphasis on catallactic activity as often experimental in nature may be used in such a way that it casts new light on firm organization. Second, we contribute to the economics of organization by incorporating issues of learning and experimentation into this body of theory.

Economic Experiments and the Market Process

Many scholars have, in different ways and from very different positions, suggested that the metaphor of experimentation is a useful way to characterize market activity.² Thus, Nelson

and Winter (1982) base their evolutionary theory on the notion that "... the market system is (in part) a device for conducting and evaluating experiments in economic behavior and organization" (Nelson and Winter 1982:277).³ In a somewhat broader context, namely that of political philosophy, openness to experiments in rules, organization, lifestyles, etc. has been one of the traditional arguments in favor of the liberal ("great", "open") society at least since the writings of John Stuart Mill. And a number of economic historians (e.g., Rosenberg and Birdzell 1986) have argued that "... the freedom to undertake ... experiments has been the essential element accounting for the fact that industrialization has been, uniquely, a historical product of capitalist societies" (Rosenberg 1992:181). Finally, it has been argued the basic problem facing public policy is the "... design of institutional arrangements that provide incentives to encourage experimentation ... without overly insulating these experiments from the ultimate test of survival" (Demsetz 1969:19). The property rights system plays the key role here (North 1990).

However, it is somewhat unclear what is actually meant by saying that the market process is one of continuous experimental activity. To clear up this is important because, as a general matter, an experiment may be a completely unpredictable "voyage of exploration into the unknown" (Hayek 1946:101) at the one extreme. Or, it may be of the completely controlled kind where the purpose of the experiment is merely to confirm once more an already well-established conjecture (Bhaskar 1978) at the other extreme. In fact, Bayesian sampling of information may in a generous interpretation be seen as experimenting.⁴ Thus, some types of experimental activity may be completely consistent with mainstream economics while others are only consistent with Austrian or radical subjectivist approaches. And some types of experiments may require firm organization while others don't.

Experimental Activity in the Market Process

A step towards clarifying this is provided by Littlechild's (1986) discussion of "three types of market process". Specifically, he (1986:27) suggests that we distinguish between "ideal type" models of the market process based on

... how the decision makers perceive of the world, how these perceptions change over time, how these additional information may be sought, and how the decision maker can limit his exposure to uncertainty.

This leads Littlechild to identify three ideal typical models, namely what he calls the "neoclassical model" (e.g., Frydman 1982), the "Austrian model" (e.g., Kirzner 1973, 1992, 1997, High 1986) and the "radical subjectivist model" (e.g., Shackle 1972, Lachmann 1986, Loasby 1976, 1991, O'Driscoll and Rizzo 1985). All three in principle make room for experimental activity, albeit of different varieties.

This may become clearer if we also consider Kirzner's (1997) distinction between two ways of portraying ignorance in economic analysis. First, mainstream models of the asymmetric information variety essentially posit that while agents are ignorant about certain things, they know precisely the extent of their ignorance and can take steps, for example, through search activities, to remedy this ignorance. For example, an agent may conjecture

that search for a certain price of a certain good in a certain geographical area is warranted in the sense that the expected benefit is larger than the expected search costs, and that conjecture may be borne out by actual events. This might be thought of as in a limited sense experimental activity. Similarly, perhaps stretching the word too far, we might think of risk-bearing behavior as broadly experimental.⁵

Second, there is also the distinct possibility that agents are actually ignorant about what they are ignorant about. In Kirzner's work, this ignorance is seen as being remedied by spontaneous discovery. This would seem to leave experimental activity out of consideration because setting up and conducting an experiment is a purposeful testing of a conjecture with an uncertain outcome and not a spontaneous discovery. However, we may think of experimental activity as one way in which agents reduce the ignorance that they are initially unaware of, for example, through serendipitous discoveries. Moreover, introducing uncertainty into the activities of the Kirznerian entrepreneur remedies the problem: if the entrepreneur's activities may be seen as uncertain conjectures about arbitrage possibilities, then surely these activities too may be characterized as experimental.

While Kirzner's distinction clearly covers what Littlechild (1986) characterizes as the neoclassical and the Austrian model, it is less clear how it relates to the radical subjectivist model; in fact, it would seem to apply only to some extent. Clearly, in the radical subjectivist model, agents are exposed to surprises (Shackle 1972). This implies that they are ignorant about their own ignorance, otherwise genuine surprises could not take place. On the other hand, the radical subjectivist model stresses imagination, the ability to construct the choice set, and the subsequent testing of choices in the market process (O'Driscoll and Rizzo 1985). It is a view that is perhaps in greater conformity with the conventional understanding of experimentation than the two other views. However, all three captures some aspects of experimental activity. We may sum up these insights in the table below.⁶

	Models of the market process		
	Neoclassical	Austrian	Radical subjectivist
Characterization of the future	The agent can fully characterize the vector of variables that is relevant for his actions and can fully characterize the probability distributions of these variables.	The future "... is a vector of which the agent knows some components but not others."	The future "... is not so much unknown as it is non-existent or indeterminate at the time of decision. The agents task is not to estimate or discover, but to create."
Agents' knowledge	Agents know what they don't know. Ignorance is reduced through search.	Agents don't know what they don't know. Ignorance is reduced through spontaneous discovery.	Same as in Austrian model. Knowledge is inherently conjectural.
Economic experimentation	Reduction of known ignorance; Bayesian updating of priors; risk-bearing.	A means to foster spontaneous discovery.	A result of imagination: a test of a bold conjecture.

As the table reveals, any sort of forward-looking and risky decision-making may be broadly characterized as experimental. However, in order to focus the discussion, we shall in the following associate experimental activity with choice situations characterized by a high degree of imperfection of knowledge about the future, and therefore a state of uncertainty that is deeper than what is normally assumed in mainstream economics. Thus, the conventional search model does not in this view portray experimental behavior. In our view, agents may still hold subjective probabilities about the outcomes of events. However, the key point is that when we are talking about experimental activity *proper*, what is involved are events about which disseminated knowledge is not present in the market.

Introducing a new product (rather than a product variation), a new process of production, or a new type of organization (e.g., Dupont's introduction of the M-form after First World War (Chandler 1962)) are instances of commercial experimental activity. In contrast, if what is involved are events that are well-understood (in terms of causal connections and possibly even probability distributions), we shall not—in our terminology—be dealing with experimental activity proper.

Implications for Economic Organization

There are some—but not many—hints scattered in the economics of organization that experimentation and economic organization are related issues. Thus, Knight (1921) stressed the forward-looking, conjectural nature of entrepreneurial activity and tied this to both the existence of profit and the nature of the firm. In Knight's view, the entrepreneur's conjectures are so much clouded by uncertainty and so much inside the entrepreneur's own head that they cannot be communicated to other agents or insured. In order to capture profit from his commercial conjecture, the entrepreneur has to set up a firm with himself in the position of residual claimant. Thus, a combination of communication costs (Foss 1993) and moral hazard (Barzel 1987) explains both the firm and profit as a residual income category in Knight's view. This is one way of linking economic organization and commercial experimentation in the marketplace.

In his discussion of the "Nature of the Firm," Coase (1937) implicitly establishes a second link. As Coase (1937) observes, it is "... improbable that a firm would emerge without the existence of uncertainty", and it is clear from the context that he has Knightian uncertainty in mind. In an often quoted passage, Coase (1937:21) notes that

It may be desired to make a long-term contract for the supply of some article or service ... Now, owing to the difficulty of forecasting, the longer the period of the contract is for the supply of the commodity or service, the less possible, and indeed, the less desirable it is for the person purchasing to specify what the other contracting party is expected to do ... Therefore, the service which is being provided is expressed in general terms, the exact details being left until a later date ... When the direction of resources ... becomes dependent on the buyer in this way, that relationship which I term a "firm" may be obtained.

While there is nothing in Coase's discussion to suggest that he had experimentation in mind, we shall suggest that one benefit of the combination of hierarchical direction and the

incomplete employment contract is that this eases the conducting of experiments inside the firm (e.g., with new technologies or organization structures) (see also Loasby 1991). More generally, the property rights structure that characterizes the firm may crucially reflect not only the desire to conduct commercial experiments but also a desire to safeguard against uncertainty and its consequences.⁷ In order to develop this view of the firm, we shall rely on property rights economics (e.g., Barzel 1997).

An Experimental View of the Firm

In this section we develop an experimental view of the firm. Our argument is based on a combination of insights about the economic implications of property rights and Austrian and radical subjectivist insights into imagination and entrepreneurial discovery. On this basis, we shall seek a rationale for firm organization in the superior ability to conduct commercial experiments that firms may have relative to markets.

Property Rights

At first glance, the property rights approach (Alchian 1965, Barzel 1989, Coase 1960, Demsetz 1964, 1969, Eggertson 1990, Libecap 1989, North 1990) seems at variance with Austrian economics.⁸ In fact, some parts of the approach, such as (certain interpretations of) the Coase theorem, have been criticized by Austrian economists (e.g., Kirzner 1973:226–227). However, what may be objectionable in the property rights approach from an Austrian point of view are not the specific analytical categories developed within this approach *per se*. In fact, Austrians have for a long time devoted interest to the category of property and its economic implications (e.g., Böhm-Bawerk 1881, Mises 1936).⁹

Conventionally, property rights include *use rights*, which define the potential uses of an asset; *income rights*, or the right to consume an asset; *rights to exclude* non-owners from access to assets, and *rights to transfer* permanently to another party all the above mentioned rights over an asset—that is to alienate or sell an assets. Barzel (1994:394) provides a convenient summing-up of the economic concept of property rights “... as an individual’s net valuation, in expected terms, of the ability to directly consume the services of the asset, or to consume it indirectly through exchange. A key word is *ability*: The definition is concerned not with what people are legally entitled to do but with what they believe they can do.”¹⁰

Because property rights define the relationships among individuals with respect to scarce assets, they are social institutions. However, it is important to observe that property rights systems may exist at several levels (among which there are hierarchical relations). Thus, the law, norms and mores of society define and delimit the range of privileges granted to individuals as assets. The combination of property rights and their institutional support is a “property rights system”. However, property rights systems also exist on lower levels than the societal level, notably inside firms (Williamson 1985, Grossman and Hart 1986, Barzel 1997). Thus, the system of property rights existing in a firm refers to the set of relations that define the position of each agent with respect to other agents and with respect to the assets with which the team works (Alchian 1984).

Historically, the property rights approach emerged from the insight that what is exchanged are not assets *per se*, but rather the rights to those assets (Coase 1960, Alchian 1965). However, the exchange of rights is not costless. For example, often physical and human assets have different properties and may sometimes yield a number of different services depending on how the assets are used. In principle, each one of the properties and different uses of assets can be specified and be subject to negotiations between parties to a transaction. Moreover, use rights over different properties or uses of assets may be shared between individuals (Barzel 1997). To specify and to contract over the different possible uses of assets are clearly costly actions—more precisely, they involve transaction costs. In the property rights framework, transaction costs are conceptualized as the costs due to the transfer, capture and protection of rights (Barzel 1997:2). When such costs exist, not everything will be specified in contracts—they are left incomplete.

Changing Property Rights

While property rights theorists have done much to clarify the meanings and ramifications of property they have done comparatively little to clarify *why* systems of property rights change over time, although some historical evidence has been brought to bear on this issue (Demsetz 1964, North 1990). *How* systems of property rights change have also been a neglected issue, because of the underlying comparative-static method in the property rights approach.¹¹

Our response to these difficulties begins from the observation that the two issues of why and how property rights change are twin issues. Thus, from an Austrian perspective property rights change because of entrepreneurial alertness;¹² alert entrepreneurs may discover that some rearrangement of existing property rights or some capture of rights that are in the public domain increase their own utility. Clearly, this is an extension of the Kirznerian view of the entrepreneur (Kirzner 1973, 1992, 1997). Kirzner tends to take the property rights structure as given, and inquire into the arbitrage activities that alert entrepreneurs pursue inside this structure. However, in our view the concept of entrepreneurial discovery should be broadened to also encompass discoveries related to re-definitions and capture of property rights, and not just to the exchange of these.

It is this augmented entrepreneurial perspective that we apply to firms. In our view, firms are prime vehicles for entrepreneurial experimentation with products and processes because the property rights systems that characterize firms often allows this experimentation to be carried out at lower costs than in markets. Moreover, and what we shall focus on in the following, firms are also vehicles for experimentation with property rights structures *themselves*. Organizational changes—such as outsourcing, changes in organizational structure, team-based management, etc.—are thus experiments with the property rights structures of firms. But so are the more mundane trials and errors involved in setting up a smoothly running production system consisting of many interdependent specialized tasks, possibly spanning several stages of production. In fact, to focus our discussion, we shall focus on exactly this kind of experimentation.

Experimenting with running a production system is only needed if there is uncertainty with respect to the best way of operating technically interdependent production systems.

In the world portrayed by the neoclassical theory of production, this is not fundamentally a problem: Everything is laid out in the book of blueprints; thus, experimentation is not necessary (Nelson and Winter 1982). However, as the Austrians emphasize production technologies are not just given: They have to be discovered, and often discovered anew, for example, when unanticipated changes in preferences, technology and regulation make a change of the firm's capital structure necessary (Lachmann 1956). In this sort of experimenting with heterogeneous production technologies, we find a key function of the entrepreneur. As Lachmann (1956:13, 16) stressed,

... We are living in a world of unexpected change; hence capital combinations ... will be ever changing, will be dis-solved and re-formed. In this activity, we find the real function of the entrepreneur.

[T]he entrepreneur's function ... is to *specify* and make decisions on the concrete form the capital resources shall have. He specifies and modifies the layout of his plant ... As long as we disregard the heterogeneity of capital, the true function of the entrepreneur must also remain hidden. In a homogenous world there is no scope for the activity of specifying.

We agree fully with Lachmann's points that interdependencies between assets are important for understanding the problem of organization, that unexpected contingencies upset existing combinations, that the entrepreneur task is to coordinate the uses of assets, and that most of the attendant problems would be trivialized in a homogeneous world.¹³ In the terminology used here, a homogeneous world would be one in which the assignment of use rights to assets would be trivialized. Since all assets would be (perfect) substitutes, there would be no problem of managed coordination, although there might be problems of moral hazard related to the use of assets, requiring some monitoring. In this world, it would be hard to discriminate between firms and markets.

Specialization and Property Rights

As Adam Smith pointed out in *The Wealth of Nations*, specialization in production is a source of productivity improvements. Specifically, he ascribes productivity gains to improvements in a worker's ability to perform a task as it is repeated more often, the time that is saved from avoiding having to switch from one task to another, and an improved ability of workers to identify labor saving innovations. At least the first and third advantages of the division of labour are related to improvements in knowledge. Thus, the discovery of new knowledge is aided by the division of labor (Richardson 1975). In fact, as Brian Loasby (1995:302) has argued:

... the division of labour is to be thought of, not as a model of the efficient allocation of a given array of skills, but as a method of fostering the development of skills, and indeed generating other kinds of knowledge. It is a discovery process.

Many of the labor saving innovations envisaged by Adam Smith are results of workers' experiments with their own tasks in their own "circumstances of time and place" (Hayek

1945). In our perspective, the extent of this experimentation depends on the allocation of property rights—notably use rights—inside the firm. Thus, there is a connection between discovery and learning on the one hand and the allocation of use rights on the other hand. This connection is a consequence of the fact that learning and discovery will often require the exercise of use rights over assets. Patterns of learning depend on the allocation of use rights between different individuals over time and specialization in production may be one reason for reallocation of use rights. Thus, specialization in production can be tied to the possession of use rights to the extent that we interpret specialization as reflecting a subdivision of use rights over assets.¹⁴

This implies that the extent of experimentation depends on how well-specified and easily monitored use rights are, since the more well specified they are, the less able are those who use assets to experiment and the more constrained will their experimentation and discovery be.¹⁵ Discretion may thus enable individuals to learn a broader set of skills and to conduct experiments which may result in innovations. In this sense, there is a direct link between property rights and possibilities of discovery.

Coordination and Property Rights

So far we have told a rosy story inspired by both Smith and Hayek in which the discretionary behavior of local agents results in productivity gains. However, discretionary behavior may not always result in such gains. First, if the discretionary behavior takes place inside a firm, shirking or other ways of appropriating a greater part of the value from the use of an asset are possible instances of discretionary behavior.¹⁶ Thus, there is a clear trade-off here between local innovativeness and the provision of incentives (Jensen and Meckling 1992). The allocation of residual income rights from the use of an asset can be a powerful means of reducing shirking.

Second, discretionary behavior may give rise to problems if strong technological interdependencies are involved.¹⁷ In this case, discretionary behavior may result in bottlenecks or in uneven development of components. From our perspective, these seemingly technological problems can in actuality be ascribed to imperfectly specified rights over assets as production tasks are subdivided. This is because it is difficult to specify all valued dimensions of assets *prior to* specialization, since many of the valued dimensions of assets only become apparent from *experimenting* with the uses of assets and discovering the best uses of those assets.¹⁸ However, given a great deal of interdependence in a complex system, the best time and place to use an asset depends on the specification of the uses of all other assets that are needed in production.

This creates costs of specialization due to unsolved coordination problems, that is, problems of making agents' plans mesh (Hayek 1937, Malmgren 1961). In firms, such coordination problems emerge as, for example, problems of bottlenecks. These are problems where complexity and interdependent activities make it difficult to specify how best to sequence various activities, or where the introduction of more specialized tools and equipment creates capacity utilization problems due to technical indivisibilities, or where innovations in individual activities result in an uneven development of tools, equipment and components. Basically these problems arise when those who deliver parts or carry out activities are not

aware of the need for mutual adjustment, or do not have the incentive to make their activities mesh with those of others.

Solving problems that arise from technological interdependencies is an important source of innovative improvements (Rosenberg 1976, Sahal 1981). However, such innovations do not emerge because of increased specialization, but because of learning in coordination. The question then arises: what governance structure best provides for experimentation and accumulation of experience in coordination? We shall follow basic Coasian arguments (Coase 1937, 1991), and stress that one of the reasons why managed coordination may be advantageous relative to price coordination is because the former reduces costs of learning about the coordination of technological interdependent tasks. We try to explicate such a view in the following.

Experimenting and Learning: The Role of Management

Virtually all contributors to the theory of the firm (Langlois 1992 being one exception) take the costs of coordinating various tasks, as well as the extent of specialization in the economy, as given. However, the cost of coordination of tasks may crucially depend on the degree of specialization. Self-management of more tasks may be an alternative to specialization that reduces overall costs of production in cases where coordination between many specialized and interdependent tasks proves costly. The degree of specialization therefore depends on the marginal costs of coordinating increasingly specialized tasks and the marginal benefits from specialization.

It is in the handling of some of the coordination problems associated with interdependencies between tasks that we may find a rationale of the firm. Specifically, firms can be viewed as solutions to problems of coordination in situations where use rights over assets cannot be perfectly specified and allocated in manners which ensures the functionality of complex technologies. Such situations may occur because agents have only limited computational capacity (Williamson 1985), making it too difficult for them to specify use rights in ways that solve problems of interdependencies. Or they may occur because agents face uncertainty in the sense that they lack ability to imagine "... the alternatives between which decisions are made" (Littlechild 1986:29).

This kind of uncertainty (which characterizes the radical subjectivist market model) has typically been attributed to the possibility of inventions that change the set of alternatives between which economic agent can choose and thus also the structure of (shadow) prices. However, uncertainty in a non-probabilistic sense is also associated with much experimental activity. In the context of firm activity, experiments take place in the form of the many trials and errors involved with setting up a smoothly running production system which consist of many interdependent specialized tasks. Of course, such experimentation is only needed if there is uncertainty with respect to the best way of operating technically interdependent production systems. Due to such technological uncertainty, firms may start different kinds of experiments and follow different paths of learning.

The firm provides a low cost way of discovering solutions to coordination problems related to bottlenecks and uneven development of components. For managed direction of resources to be efficient, it is required that entrepreneurs are at least as qualified in discovering the

relevant prices (that is, finding the highest valued uses of assets) as independent contractors would be.¹⁹ Otherwise, costs of transacting may be saved at the expense of efficiency in the use of resources. If entrepreneurs are better able to determine the valuable uses of resources compared to other agents, entrepreneurs have an ownership advantage over resources. Such an advantage explains the single person firm, but not necessarily why entrepreneurs hire employees who are prepared to take orders within certain limits in order to take advantage of this knowledge. Entrepreneurs could as well rent the labor time of an agent in return for the exercise of a certain well specified task.

However, in actuality, entrepreneurs stand a good chance of acquiring superior knowledge about the best uses of the assets that make up a complex technology. From the innovation literature, it is apparent that the solution to problems of bottlenecks and uneven development in components are based on learning by doing in production and development (Rosenberg 1976, Sahal 1981). The argument here is that this experience from learning by doing is probably more easily accumulated within the boundaries of firms. One of the reasons why one might expect this learning to be less costly within the boundaries of firms may be that entrepreneurs who hold residual rights over assets—including rights to re-define and reallocate specific rights—are able to conduct experiments. They can do this without continuously having to re-negotiate contracts (which will have more or less unforeseen outcomes because of the uncertain nature of the experimental process). This saves all sorts of costs related to time, bargaining and contract drafting.²⁰

Entrepreneurs are then able to create “controlled” experiments in which they only change some aspects of the tasks in order to trace the effects of some specific re-arrangements of rights. Setting up a controlled experiment may be more difficult across the boundaries of firms, particularly when interdependencies exist between firms and if it is difficult to specify all the tasks which must and must not be changed. Coordinating interdependent tasks within the boundaries of a firm may provide entrepreneurs with a more complete picture of the nature of interdependencies. Such information is not only important in relation to eliminating bottlenecks, but also in relation to avoiding problems of uneven development of components by setting up interface standards and other more permanent solutions.

So far, the argument has been that relative to markets, firms may economize on the transaction costs of learning the best way of coordinating technological interdependent systems. Now, once a firm has discovered how to coordinate some specialized tasks, there would be little advantage from managed direction relative to market transacting, and coordination by order contracts would substitute for coordination by management.²¹ However, such specialization between firms would give way to economic gains from further specialization in tasks, and this *in turn* would create new uncertainty and new opportunities for reducing coordination costs by experimenting. In other words, there will be an *ongoing process* of specialization in tasks, learning in coordination and specialization between firms and new ways of coordination will continuously be imagined by entrepreneurs, much like the process of cumulative causation envisaged by Allyn Young (1928). Thus, firms contain many mechanisms that *endogenously* produce change, such as the (related) mechanisms of ongoing learning, experimenting, and changes in the division of labor. Therefore, while there may be optimal time paths of firm growth, our reasoning would indicate that it is doubtful whether there is an optimum size of the firm (cf. also Penrose 1959).

Conclusion

In this paper, we have brought Austrian ideas to bear on the theory of the firm. In particular, we have argued that it is possible to arrive at an experimental view of the firm from broadly Austrian principles. Thus, the experimental view of the firm developed here stresses the role of the firm as a repository for a broad range of experiments, mostly with production technology. It is a view that stresses the role of discovery and learning. However, experimental activities are in general costly, and are particularly so when experimentation with strongly interdependent technologies is involved. The costs of coordinating such technologies may be reduced by bringing them in-house. This explains the existence of the firm from an experimental point of view.

The story we have tried to tell in this paper is broadly consistent with much of the modern economics of organization. Thus, we have borrowed ideas from the property rights literature (e.g., Barzel 1997), and have applied these ideas to settings involving complementarities between assets and activities (Milgrom and Roberts 1992, Hart 1995). However, we have given these ideas distinctively Austrian and radical subjectivist interpretations, first, by stressing the experimental nature of economic activity, second, by arguing that a primary task of the entrepreneur/manager is to conduct controlled experiments with interdependent production technologies, and, third, by stressing that the goal of these experiments is to achieve internal plan consistency (i.e., make the production process run smoothly). Clearly, all this can be taken further. For example, entrepreneurs also initiate experiments in order to launch new products that in turn may be tested in the experimental procedure of the market process. However, our main aim in this paper has been to suggest that Austrian and radical subjectivist ideas mesh with important insights in mainstream economics, and that new insights emerge from combining these bodies of theory.

Notes

1. Unless, of course, we include Schumpeter in the ranks of the Austrians.
2. In spite of the connotations to closed-system conditions in natural science that the word carries with it (Bhaskar 1978).
3. These include Schumpeter (1911, 1943), Mises (1936, 1949), Hayek (1946, 1968), Alchian (1950), O'Driscoll and Rizzo (1985), Pelikan (1988), Eliasson (1990), Loasby (1991), Rosenberg (1992), and Harper (1996).
4. See Cyert and Kumar (1996) for this interpretation.
5. A relevant consideration in this connection is whether information about a risky event is generally shared or not. Thus, risk-taking behavior when there is substantial disagreement about the probability of the occurrence of a certain event (and it is therefore hard to insure against) is more deserving of being called experimental than when there is agreement on the probability (and the event is therefore easily insurable).
6. The quotations in the table are from Littlechild (1986:24).
7. Littlechild (1986:35) suggested something similar when he argued that "... ownership of a resource reduces exposure to unexpected events. Property rights are a means of reducing uncertainty without needing to know precisely what the source or nature of the future concern will be", and this overall insight can arguably be found in much of the modern theory of the firm (Grossman and Hart 1986, Hart 1995, Williamson 1996).
8. Note that we primarily refer to the "older" property rights approach of Coase, Alchian, Demsetz, Barzel, etc. rather than to the more recent property rights approach that has been developed by Oliver Hart and various colleagues (e.g., Grossman and Hart 1986, Hart and Moore 1990). For an argument that these are two different

approaches and that older approach is some important dimensions superior to the more recent one, see Foss and Foss (2001).

9. The aspects that an Austrian may object to are rather the assumptions in the approach that agents always seek to maximize the value of the rights they control and that the process of exchanging rights can be represented in terms of equilibrium. Indeed, at least one writer (Eggertson 1990) characterizes the approach as “generalized neoclassical economics”. But Austrians should not have problems with the basic notion that property rights are the rights people hold over assets.
10. This, we note in passing is completely consistent with Mises’ point that ownership refers to “the power to use economic goods”, that “... ownership is the *having* of the goods which the economic aims of men require”, and that “... the economic significance of the legal *should have* lies only in the support it lends to the acquisition, the maintenance and the regaining of the natural *having*” (Mises 1936:27).
11. In Demsetz’ (1967) famous example of how property rights changed among ... indians, the process of change itself is thus a black box.
12. In the political realm, this process of entrepreneurs influencing the definition of property rights is of course known as “rent-seeking.” The concept has also been applied to firms’ internal organization (Milgrom 1988). But entrepreneurs grasping rights is a much wider concept than the concept of rent-seeking. Any attempts to capture rights that are in the public domain (Barzel 1997) may thus be seen as manifestations of entrepreneurial alertness.
13. By a “homogenous world”, Lachmann means one where assets are only substitutes, not complements, and, furthermore, that all capital assets (save perhaps for human capital) are perfect substitutes.
14. So that each individual holds rights over a more narrow set of assets or holds a more narrow set of rights over the same assets.
15. If, for example, the manner in which a computer operator runs a program is pre-specified in a contract and easily monitored, his learning by doing may be limited to improving the speed with which he activates the keyboard. If he has greater discretion in deciding how to operate the program, he might have a greater opportunity for learning by experimenting.
16. In Leijonhufvud’s (1986) story, the interdependencies that characterize the division of labour also introduce the possibility of hold-up (Klein, Crawford, and Alchian 1978, Williamson 1985). We neglect this possibility here.
17. See Milgrom and Roberts (1992:chapter 4). The concept of “complementarities” in the modern economics of organization (Milgrom and Roberts 1992, Hart 1995) covers much of what we mean by interdependencies. (Complementarities/interdependencies were also much emphasized in Austrian capital theory, e.g., Lachmann 1956). However, in contrast to the modern economics of organization, we emphasize coordination rather than hold-up problems and the like.
18. Even if important dimensions can in fact be specified, it may be difficult to allocate these rights in ways that ensure the best use of assets. This may, for example, be the case with the time and place dimension of assets where non-optimal allocations result in excess stocks of intermediate products or in idle assets.
19. Coase (1937) mentions “..increasing opportunity costs due to the failure of entrepreneurs to make the best use of the factor of production” (p. 23) as one of the factors which set a limit to the efficient size of a firm. He also assumes that “..the costs of losses through mistakes will increase with an increase in the spatial distribution of the transactions organized, in the dissimilarity of the transactions, and in the probability of changes in the relevant prices. As more transactions are organized by an entrepreneur, it would appear that the transactions would tend to be either different in kind or in different places” (p. 25). Managers, in other words, have limited capacity to “discover the relevant prices” and this increases mistakes as more and more dissimilar transactions are organized in a firm.
20. In this connection wage contracts may be an efficient way of sharing risks from experimenting.
21. Managed direction could still be advantageous in cases where adaptation of interdependent production systems to unforeseen contingences were called for.

References

- Alchian, A. A. [1977 (1950)] “Uncertainty, Evolution, and Economic Theory.” Reprinted in Alchian, *Economic Forces at Work*. Indianapolis: Liberty Press.

- Alchian, A. A. [1977 (1965)] "Some Economics of Property Rights." Reprinted in Alchian, *Economic Forces at Work*. Indianapolis: Liberty Press.
- Alchian, A. A. (1984) "Specificity, Specialization, and Coalition." *Journal of Institutional and Theoretical Economics*, 140: 34–49.
- Arrow, K. J. (1962) "Economic Welfare and the Allocation of Resources for Invention." In *The Rate and Direction of Inventive Activity: Economic and Social Factors*. Princeton: Princeton University Press.
- Barzel, Y. (1982) "Measurement Costs and the Organization of Markets." *Journal of Law and Economics*, 25: 27–48.
- Barzel, Y. (1987) "The Entrepreneur's Reward for Self-Policing." *Economic Inquiry*, 25: 103–116.
- Barzel, Y. (1994) "The Capture of Wealth by Monopolists and the Protection of Property Rights." *International Review of Law and Economics*, 14: 393–409.
- Barzel, Y. (1997) *Economic Analysis of Property Rights*, 2nd ed., Cambridge: Cambridge University Press.
- Bhaskar, R. (1978) *A Realist Theory of Science*. Brighton: Harvester-Wheatsheaf.
- Boettke, P. and Prychitko, D. (Eds.) (1996) *Market Process Economics* (2 Vols.). Aldershot: Edward Elgar.
- Boudreaux, D. and Holcombe, R. G. (1989) "The Coasian and Knightian Theories of the Firm." *Managerial and Decision Economics*, 10: 147–154.
- Böhm-Bawerk, E. von [1962 (1881)] "Whether Legal Rights and Relationships are Economic Goods." In: Sennholz, H. (Ed.) *Shorter Classics of Böhm-Bawerk*. South Holland: Libertarian Press.
- Casson, M. (1997) *Information and Organisation*. Oxford: Oxford University Press.
- Chandler, A. D. (1962) *Strategy and Structure*. Cambridge, MA: MIT Press.
- Cheung, S. N. S. (1983) "The Contractual Nature of the Firm." *Journal of Law and Economics*, 26: 1–22.
- Coase, R. H. [1991 (1937)] "The Nature of the Firm." *Economica*, 4: 386–405; In: Williamson, O. E. and Winter, S. G. (Eds.) *The Nature of the Firm*, Oxford: Oxford University Press.
- Coase, R. H. (1960) "The Problem of Social Cost." *Journal of Law and Economics*, 3: 1–44.
- Coase, R. H. [1991 (1991)] "The Nature of the Firm: Origin, Meaning, Influence." In: Williamson, O. E. and Winter, S. G. (Eds.) *The Nature of the Firm*, Oxford: Oxford University Press.
- Cordato, R. E. (2000) "Chasing Phantoms in a Hollow Defence of Coase." *Review of Austrian Economics*, 13: 193–208.
- Cyert, R. M. and Kumar, P. (1996) "Economizing by Firms through Learning and Adaptation." *Journal of Economic Behavior and Organization*, 29: 211–231.
- D'Aveni, R. (1994) *Hypercompetition: The Dynamics of Strategic Maneuvering*. New York: Basic Books.
- Demsetz, H. (1964) "The Exchange and Enforcement of Property Rights." *Journal of Law and Economics*, 7: 11–26.
- Demsetz, H. [1988 (1967)] "Toward a Theory of Property Rights." Reprinted in Demsetz, *Ownership, Control, and the Firm*. Oxford: Basil Blackwell.
- Demsetz, H. [1989 (1969)] "Information and Efficiency: Another Viewpoint." Reprinted in Demsetz, *Efficiency, Competition and Policy*. Oxford: Basil Blackwell.
- Eggertson, T. (1990) *Economic Behavior and Institutions*. Cambridge: Cambridge University Press.
- Eliasson, G. (1990) "The Firm as a Competent Team." *Journal of Economic Behavior and Organization*, 13: 275–298.
- Foss, K. (2001) "Organizing Technological Interdependencies: A Coordination Perspective on the Firm." *Industrial and Corporate Change*, 10: 151–178.
- Foss, N. J. (1993) "Theories of the Firm: Contractual and Competence Perspectives." *Journal of Evolutionary Economics*, 3: 127–144.
- Foss, N. J. (1999) "The Use of Knowledge in Firms." *Journal of Institutional and Theoretical Economics*, 155: 458–486.
- Foss, N. J. (2000) "'Playing Market' in Oticon." Available at <http://www.cbs.dk/link/papers/>
- Foss, N. J. (2001) "Leadership, Beliefs and Coordination." *Industrial and Corporate Change*, 10: 357–388.
- Foss, N. J. (2001c) "Coase vs Hayek: Economic Organization in the Knowledge Economy." Available at <http://www.cbs.dk/link/papers/>
- Foss, K. and Foss, N. J. (2000a) "Learning in Firms: Knowledge-Based and Property Rights Perspectives." *European Journal of Social and Economic Systems*, 14: 119–142.

- Foss, K. and Foss, N. J. (2000b) "Theoretical Isolation in Contract Economics." *Journal of Economic Methodology*, 7: 313–339.
- Foss, K. and Foss, N. J. (2001) "Assets, Attributes and Ownership." *International Journal of the Economics of Business*, 8: 19–37.
- Frydman, R. (1982) "Towards an Understanding of Market Processes." *American Economic Review*, 72: 652–668.
- Grossman, S. and Hart, O. (1986) "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration." *Journal of Political Economy*, 94: 691–719.
- Gunning, J. P. [(2000a)] "Roy Cordato's 'Austrian' Critique of Coase on Social Cost." *Review of Austrian Economics*, 13: 175–192.
- Gunning, J. P. (2000b) "The Property System in Austrian Economics: Ronald Coase's Contribution." *Review of Austrian Economics*, 13: 209–220.
- Harper, D. (1996) *Entrepreneurship and the Market Process: An Enquiry Into the Growth of Knowledge*. London: Routledge.
- Hart, O. [1991 (1991)] "Incomplete Contracts and the Theory of the Firm." In: Williamson, O. E. and Winter, S. G. (Eds.). *The Nature of the Firm*, Oxford: Oxford University Press.
- Hart, O. (1995) *Firms, Contracts, and Financial Structure*. Oxford: Clarendon Press.
- Hart, O. and Moore, J. (1990) "Property Rights and the Nature of the Firm." *Journal of Political Economy*, 98: 1119–1158.
- Hayek, F. A. von [1948 (1937)] "Economics and Knowledge." Reprinted in von Hayek, *Individualism and Economic Order*. Chicago: University of Chicago Press.
- Hayek, F. A. von [1948 (1945)] "The Use of Knowledge in Society." Reprinted in von Hayek, *Individualism and Economic Order*. Chicago: University of Chicago Press.
- Hayek, F. A. von [1948 (1946)] "The Meaning of Competition." Reprinted in von Hayek, *Individualism and Economic Order*. Chicago: University of Chicago Press.
- Hayek, F. A. von [1978 (1968)] "Competition as a Discovery Procedure." Reprinted in von Hayek, *New Studies in Philosophy, Politics, Economics, and the History of Ideas*. London: Routledge and Kegan Paul.
- Helper, S., MacDuffie, J. P., and Sabel, C. (2000) "Pragmatic Collaborations: Advancing Knowledge While Controlling Opportunism." *Industrial and Corporate Change*, 9: 443–487.
- High, J. (1986) *Maximizing, Action, and Adjustment*. München: Philosophia Verlag.
- Jacobson, R. (1992) "The Austrian School of Strategy." *Academy of Management Review*, 17: 782–807.
- Jensen, M. C. and Meckling, W. H. [1992 (1992)] "Specific and General Knowledge and Organizational Structure." In: Werin og L. and Wijkander, H. (Eds.) *Contract Economics*. Oxford: Blackwell.
- Kirzner, I. M. (1973) *Competition and Entrepreneurship*. Chicago: University of Chicago Press.
- Kirzner, I. M. (1992) *The Meaning of the Market Process*. London: Routledge.
- Kirzner, I. M. (1997) "Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach." *Journal of Economic Literature*, 35: 60–85.
- Klein, P. (1996) "Economic Calculation and the Limits of Organization." *Review of Austrian Economics*, 9: 3–28.
- Klein, B. R., Crawford, G., and Alchian, A. A. (1978) "Vertical Integration, Appropriable Rents, and the Competitive Contracting Process." *Journal of Law and Economics*, 21: 297–326.
- Klein, P. and Klein, S. (2001) "Do Entrepreneurs Make Predictable Mistakes? Evidence from Corporate Divestitures." *Quarterly Journal of Austrian Economics*, 4: 3–23.
- Knight, F. H. [1964 (1921)] *Risk, Uncertainty, and Profit*. New York: Augustus M. Kelley.
- Kreps, D. M. (1996) "Markets and Hierarchies and (Mathematical) Economic Theory." *Industrial and Corporate Change*, 5: 561–595.
- Lachmann, L. M. [1978 (1956)] *Capital and Its Nature*. Kansas City: Sheed Andrews and MvNeel.
- Lachmann, L. M. (1986) *The Market as an Economic Process*. Oxford: Blackwell.
- Langlois, R. N. (1992) "Transaction Cost Economics in Real Time." *Industrial and Corporate Change*, 1: 99–127.
- Langlois, R. N. and Foss, N. J. (1999) "Capabilities and Governance: The Rebirth of Production in the Theory of Economic Organization." *KYKLOS*, 52: 201–218.
- Langlois, R. N. and Robertson, P. L. (1995) *Firms, Markets and Economic Change*, London: Routledge.
- Lavoie, D. (1985) *Rivalry and Central Planning*. Cambridge: Cambridge University Press.
- Leijonhufvud, A. [1986 (1986)] "Capitalism and the Factory System." In: Langlois, R. N. (Ed.) *Economics as a Process*, Cambridge: Cambridge University Press.

- Lewin, P. and Phelan, S. E. (2000) "An Austrian Theory of the Firm." *Review of Austrian Economics*, 13: 59–79.
- Littlechild, S. C. [1986 (1986)] "Three Types of Market Process." In: Langlois, R. N. (Ed.) *Economics as a Process*, Cambridge: Cambridge University Press.
- Loasby, B. J. (1976) *Choice, Complexity, and Ignorance*. Cambridge: Cambridge University Press.
- Loasby, B. J. (1991) *Equilibrium and Evolution*. Manchester: Manchester University Press.
- Loasby, B. J. (1995) "The Division of Labour." *History of Economic Ideas*, 4: 299–323.
- Malmgren, H. B. (1961) "Information, Expectations, and the Theory of the Firm." *Quarterly Journal of Economics*, 75: 399–421.
- Miles, R. E., Snow, C. C., Mathews, J. A., Miles, G., and Coleman, H. J., Jr. (1997) "Organizing in the Knowledge Age: Anticipating the Cellular Form." *Academy of Management Executive*, 11: 7–20.
- Milgrom, P. and Roberts, J. (1992) *Economics, Organization, and Management*. Englewood Cliffs: Prentice-Hall International.
- Mises, L. von [1981 (1936)] *Socialism*. Indianapolis: Liberty Press.
- Mises, L. von (1949) *Human Action*. London: William Hodge.
- Nelson, R. R. and Winter, S. G. (1982) *An Evolutionary Theory of Economic Change*. Cambridge, MA: Belknap Press.
- North, D. C. (1990) *Institutions, Institutional Change, and Economic Performance*. Cambridge: Cambridge University Press.
- O'Driscoll, G. P. and Rizzo, M. (1985) *The Economics of Time and Ignorance*. Oxford: Basil Blackwell.
- Pelikan, P. [1988 (1988)] "Why the Imperfect Innovation System of Capitalism Cannot be Outperformed." In: Giovanni Dosi et al. (Eds.) *Technical Change and Economic Theory*. London: Pinter.
- Penrose, E. T. (1959) *The Theory of the Growth of the Firm*. Oxford: Oxford University Press.
- Richardson, G. B. [1998 (1975)] "Adam Smith on Competition and Increasing Returns." Reprinted in Richardson, *The Economics of Imperfect Knowledge*. Aldershot: Edward Elgar.
- Rosenberg, N. (1976) *Perspectives on Technology*, Cambridge: Cambridge University Press.
- Rosenberg, N. (1992) "Economic Experiments." *Industrial and Corporate Change*, 1: 181–203.
- Rosenberg, N. and Birdzell, L. (1986) *How the West Grew Rich*. New York: Basic Books.
- Sahal, D. (1981) *Patterns of Technological Innovation*. Reading: Addison-Wesley.
- Schumpeter, J. A. [1983 (1911)] *The Theory of Economic Development*. New Brunswick: Transaction Publishers.
- Schumpeter, J. A. [1975 (1943)] *Capitalism, Socialism and Democracy*. New York: Harper & Row.
- Shackle, G. L. S. (1972) *Epistemics and Economics*. Cambridge: Cambridge University Press.
- Smith, A. [1981 (1776)] *An Inquiry Into the Nature and Causes of the Wealth of Nations*. Indianapolis: Liberty Press.
- Williamson, O. E. (1985) *The Economic Institutions of Capitalism*. New York: Free Press.
- Young, A. (1928) "Increasing Returns and Economic Progress." *Economic Journal*, 38: 527–542.
- Zenger, T. and Hesterly, W. S. (1997) "The Disaggregation of Corporations: Selective Intervention, High-Powered Incentives, and Molecular Units." *Organization Science*, 8: 209–222.